THE POLITICAL ECONOMY STRUCTURES OF ENERGY TRANSITIONS: FROM SHALE GAS TO RENEWABLE ENERGY

Presentation in the IAEE European conference, Vienna 3-7.9.2017, session 5F Renewable energy

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The US and German energy transitions, what & why?

- The switch towards using new resources in the USA and Germany results in *a new energy mix* where different *fossil and non-fossil resource sectors are interdependent*
- Our primary interest is in these *complex interrelationships* among choices vis-a-vis the new resources available and in the *difficulty of controlling the outcomes*
- As the transitions extend to new sectors of society, involving new actors, they *must reconcile several interests to be successful: cross-sectoral policies indispensable*
- This calls for *interdisciplinary research* in the IPE of energy

- We respond to the call for interdisciplinarity by applying the purposefully open *structuration approach* to the study of energy transitions
- No single causality/mono-theoretical assumptions
- We propose a more comprehensive analysis of the *actors* in energy transitions, their *interests* & the *structures enabling and constraining* their conduct with both material and social qualities

Research questions & basis for comparison

1. *What interests drive the actors in the energy transitions in the USA and Germany?*
2. *How do the complex structures of political economy enable and constrain their conduct?*

- Both cases highly adaptable 'open access orders' (North; Andrews-Speed 2016; Lockwood et al. 2017) conducive for transitions
- But they examplify different varieties of capitalism
- No direct comparisons exist so far of these landmark cases for the IPE of energy pursuing unprecedented measures in the shale and renewable sectors respectively

The structuration approach covers a broader scope of structures shaping energy transitions than e.g. sociotechnical systems or institutionalist approaches

Federal-state level governments, regulators & agencies	Producers of fuels, electricity and heat; equipment, service & consultancy companies	Network infrastructure developers	Regional & local actors, consumers & prosumers	International & national financial institutions

***Interests* of actors vs. the energy system: security of supplies; socioeconomic issues; profits & fiscal gains; R&D; foreign policy; environmental stewardship; efficiency**

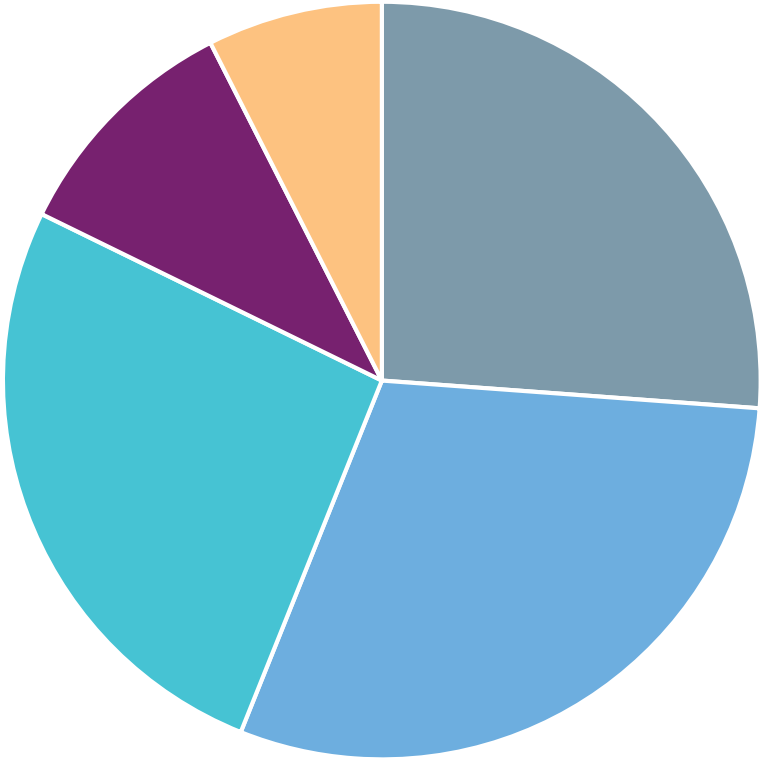
Structure (policy environment): constraints and enablers			
Resources, technology & infrastructure	*Finance, markets and business models*	*Institutions*	*Ecology*
Resources used for energy production (fuels; electricity and heat, industrial needs)	Investment and production costs; taxation regime	Formal institutions incl. regulation (EU/NAFTA/federal/state); agreements, contracting, permits and licenses	Risks to natural environment (accidents, water pollution, etc.)
Network infrastructure incl. pipelines, railroads, terminals, transmission & distribution networks; local networks and microgrids	Organisation of energy markets incl. subsidies & trading systems; balance between supply and demand	Informal institutions including relations among authorities, producers, consumers and NGOs including citizens	Use of land and space for energy extraction and production vs. other economic activities and recreation
Technologies incl. extraction, conversion, storage, network automation, gas turbines, wind turbines, solar panels, etc.	Energy business models incl. services, maintenance, management	Global and regional institutions influencing governance and order among energy actors and stakeholders	GHGs and other emissions into the air and atmosphere

Outputs: similarities and differences in the energy transitions of the USA and Germany

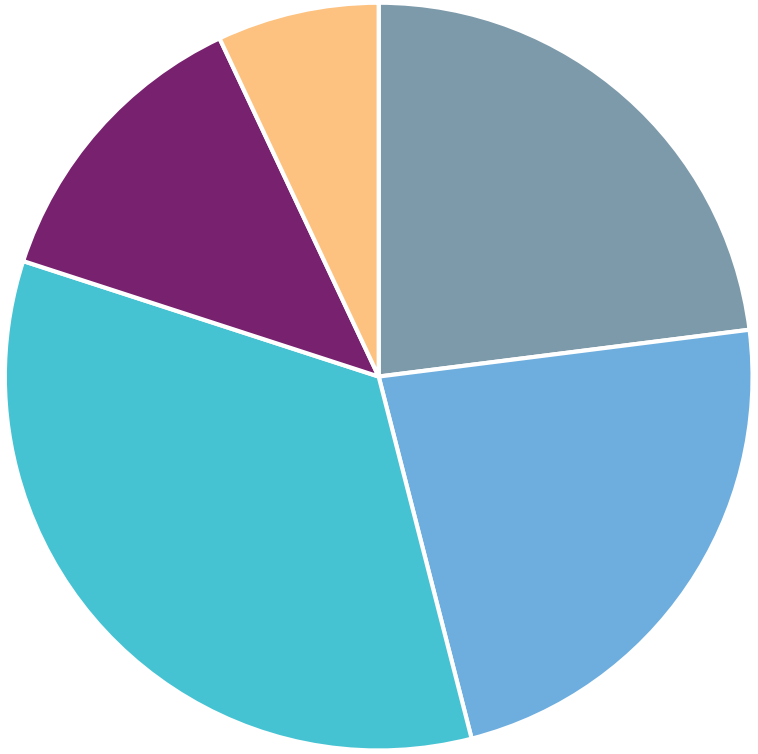
Path dependencies

Fossil fuels and renewables depend on each other if we wish to further all interests attached vis-a-vis the energy system

US energy mix 2015



German energy mix 2016



Results: in the USA 'energy mix' is a goal of its own, in Germany it is a transitory state

	Resources, technology & infrastructure	*Finance, markets and business models*	*Institutions*	*Ecology*
USA	Federal Government supports both shale and renewable sectors by means of R&D, to promote its fiscal interests and access to low-cost electricity, and to substitute imports of natural gas and part of coal & potentially some oil	Bottom-up proliferation of shale gas producers creates gas-to-gas competition; stable nuclear production, technological progress & federal support for renewables further help to keep prices down	Several rounds of regulation facilitated the breakthrough of the shale industry, supporting the business and fiscal interests, mitigating the related environmental concerns & responding to security of supply issues	The academia and industry work together to control the environmental risks of the shale industry, which in the long run can only modestly lower GHG and other emissions
Germany	Many vested interests and path-dependencies maintaining existing technologies and infrastructures to overcome, esp. in transport; electricity generation needs back-up power (natural gas) although incumbents have developed a business interests in decarbonisation. Some tensions between decentralisation and centralisation of the grid.	Low fossil fuel prices and subsidised renewables keep wholesale prices low in the interest of industrial buyers. The new lock-in to feed-in-tariffs does not optimally support R&D interests. New business models emerge owing to the highly variable output of solar and wind power and decentralisation.	Incumbent and emerging market actors brought together around a common profit interest in continued feed-in tariffs. Some institutional change from the EU level, integration supporting the German transition with back-up capacity through cross-border trade in electricity and natural gas & policy coordination.	The long-term decarbonisation prospects are more genuine than in the USA but land use and maritime landscape issues set constraints for wind power. Vis-à-vis environmental interests the German bioenergy sector is not prioritised by the Government.

Conclusions: comparison of the two cases

- The US transition deliberately maintains many path-dependencies of the fossil fuels–based economy while it emerges alongside a new renewable economy
- It addresses environmental issues with regulatory constraints imposed by the government to prevent risk to profits and the wider economic effects that they expedite

- Germany seeks to reduce the risks of nuclear energy domestically in the short-to-medium term, and in the long term, a reduction of GHG emissions
- Several path-dependencies need to be broken on the demand side in favour of a more decentralised energy system involving more citizen and prosumer participation and flexible consumption
- However, owing to the complex interrelationships among resource sectors, the German transition has not so far delivered more vis-à-vis its long-term objectives than the US case

Conclusions: the global level implications

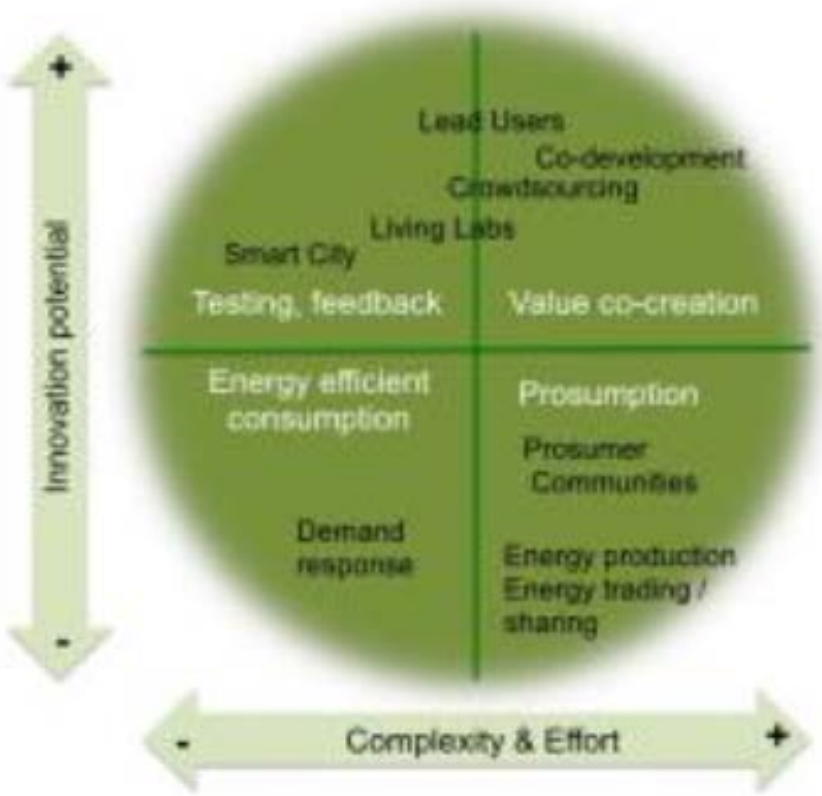
- The German energy transition explicitly supports technology exports as a federal level objective, having first adopted wind power technologies from Denmark in the 1990s, and then diffusing these further:
  - Facilitates innovation, learning and cost reduction to gradually make subsidies redundant
- The *competitiveness of renewable energy* technologies and solutions *depends on the global prices and trade in competing energy resources*, including oil and natural gas, and the effects of the *shale revolution which increases competition*

Vs., or plus?

Conclusions: the structuration approach

- R&D is a major driver of the transition. Our structuration approach reveals:
  - The *innovation niches*, pointed out by studies on socio-technical systems, belong in our framework to the dimension of *resources, technologies and infrastructure*, but depend on the dimension of *finance, markets and business models,* and on the *institutional dimension*
- Most US policies address supply side
- In Germany, demand side measures more widespread but hit institutional constraints: inadequate coordination vis-à-vis regulations on buildings and transport; and on our financial dimension in terms of insufficient policy innovation to keep up with market developments

- The German model creates demand for new services in planning, consultancy, equipment installation & energy efficiency; facilitates the emergence of prosumers and aggregators of small-scale production



Conclusions: markets vs. wider societal interests

- Little steered markets such as the US one unable to cater for the wider interests of the state and society in the transition, e.g. vis-à-vis energy efficiency
- This *dilemma of serving disparate interests* remains also unresolved in Germany:
  - E.g. the long-term aim of converting towards intermittent, emerging technologies in the power markets does not serve *security of supply interests* as well as does the shale-derived oil and gas in the USA
- Although the US transition stems from *liberal features* of the market economy, *full autonomy in markets will not produce an energy transition* (esp. environmentally sustainable one)
- The more coordinated capitalism of Germany also faces constraints and unintended consequences: debate on *state transformation = different state responses*

- *Here our structuration approach draws attention to the difficulties in reconciling state interests & policies with the structural context including all its dimensions*